6643-A-0398
Appendix M

Trainer Description for Device 2F201
E/F TACTICAL OPERATIONAL FLIGHT TRAINER (E/F TOFT)
Serial Number 135
Located at NAF Atsugi, Japan

1.0 **TRAINER DESCRIPTION**

1.1 Function and General Description:

a. The Tactical Operational Flight Trainer (TOFT) was built by L3 COMMUNICATIONS, Training Systems Inc., Arlington, Texas. The trainer is designed to provide a realistic, interoperable, full spectrum combat training environment training for FA-18 pilots with capability to provide for advanced pilot training in weapon systems operations. The TOFT is used for training FA-18 pilots in the following areas:

- . Full aircraft ground and airborne systems operations
- . Limited Air Combat Maneuvering (ACM)
- . Air-to-Air (A/A) Weapons Delivery
- . Radar Imagery
- . Radar Warning System Operation
- . Carrier Approach and Landings
- . Normal/Emergency procedures
- . Air-to-Ground (A/G) Weapons Delivery
- . Targeting FLIR
- . Joint Helmet Mounted Cueing System (JHMCS)

The TOFTs are built with split cockpit configuration. The cockpit instruments are categorized into two groups: simulated or nonfunctional three-dimensional duplicates provided for configuration only. TOFTs are configured to simulate the FA-18 E/F aircraft and are linked together to provide crew training.

b. The TOFT device consists of the following functional systems: separate Pilot and Weapon System Officers (WSO) training stations, host computer system, visual systems, instructor/operator station (IOS), trainee station system, pneumatics system, Instructor/Operator System (IOS), digital computer complex with peripherals, Input/Output (I/O), Communication and a power distribution system.

c. The TOFT simulates the accuracy and response of the FA-18 E/F controls, instruments, flight performance and characteristics, radar system, and weapons systems. This simulation is supported by a visual display system that presents terrain, airfield, ocean surface, atmospheric phenomena, surface and air target images, and missile trails as viewed from the cockpit. An aural system generates tactical tones and environmental sounds. Instructional features include preprogrammed insertion of malfunctions, recording of carrier conditions, ejection parameters, and computer-generated voice messages.

1.2 Trainee Station:

1.2.1 The TOFT trainee stations are a reproduction of the operating environment of the actual aircraft. The flight controls, multipurpose display and control group, and instrument panel pedestal are simulated

aircraft components. The console assemblies are a replica of the aircraft's except that the construction is modified to fulfill the trainer needs. The trainee compartment for the back seat is slightly different from the front seat due to FA-18 E/F forward and aft equipment differences.

1.2.2 Each of the trainee stations consists of two basic subsystem elements: (1) replicate cockpit and (2) visual system. TOFTs simulate the FA-18 E/F model aircraft.

1.2.3 The pilot trainee station cockpits encompasses the following subsystems:

a. Power-plant Systems. The F404-GE-400/404 engines of the design basis aircraft are simulated together with the related controls, control and instruments. Static and dynamic engine performance is simulated along with the associated instrument indications, fuel consumption, and sound.

b. Fuel System. The fuel system of the design basis aircraft is simulated for quantity indication, fuel available logic, weight, and center of gravity. Instructor controls are provided to vary the total fuel quantity, including drop tanks, with the range of its capacity. The instructor may freeze the fuel system, at any point during the mission.

c. Secondary Power System. The functions of the secondary power system of the design basis aircraft are simulated together with the related control, indications, and displays.

d. Electrical Power Supply System. The electrical system is simulated to the extent of cockpit indications and control and bus logic for the left and right generators, utility and emergency batteries and external ground power.

e. Hydraulic Power Supply System. The hydraulic system (HYD 1 and HYD 2) of the design basis aircraft is simulated for system control distribution logic. The normal hydraulic pressure is provided except for malfunctions.

f. Flight Control System. The flight controls of the design basis aircraft are simulated for feel and aerodynamic response.

g. Automatic Flight Control System (AFCS). Dynamic simulation of the AFCS is provided.

h. Landing Systems. Simulation of the landing gear, nose-wheel steering, brakes, launch bar, and arresting hook is provided.

i. Instruments, Indicators, and Displays. Simulation of the following equipment is provided:

(1) Heads Up Display (HUD)
(2) Left Multi-Purpose Indicator (MDI)
(3) Right Multi-Purpose Indicator (MDI)
(4) Multi-Purpose Color Display (MPCD)
(5) Up Front Control (UFC)
(6) Angle of Attack (A0A) Indexer

(7) Attitude Reference Indicator (ARI)
(8) Standby Airspeed Indicator
(9) Standby Rate-of-Climb Indicator
(l0) Standby Magnetic Compass
(11) Radar Altimeter
(l2) Cockpit Altimeter

j. Fire Detection/Extinguishing Systems. The fire detection/extinguishing system is simulated to the extent of cockpit indication and engine performance only.

k. Entrance/Egress System. Through Pneumatic controlled Visual Facet.

l. Ejection Seat. Replica of aircraft seat. Non-functional

m. Environmental Control System. Non-Functional

n. Oxygen System. Non-Functional

o. Air Data Computer. Simulated including all required inputs.

p. Communications-Navigation-Identification Equipment

q. JHMCS. Simulated including all required inputs.

(1) Intercom System. Simulation of the intercom systems permits communications between the pilot and the instructor with the instructor corresponding to a ground or ship based control agency. Control and signal processing of audio tones, which are simulated, provide for all systems in the same manner as in the design basis aircraft. In FA-18 E/F aircraft intercom system also provides for communications between pilot to WSO, IOS and WSO, WSO to pilot, and WSO to IOS.

(2) UHF Communications System (AN/ARC-182). The two receiver-transmitters (COMM1 and COMM 2) are simulated for both communications and automatic direction finder (ADF) functions. The system provides appropriated communication links between the IOS and the Trainee Station.

(3) Tactical Air Navigation (TACAN) System (AN/ARN-118). The TACAN system is simulated for relative bearing and slant range distance indication to a ground station. Station identification tones are simulated.

(4) Inertial Navigation System (AN/ASN-130). The inertial navigation system is simulated, including inertial platform orientation, signal data converter, controls and indicators, and all alignments.

(5) Backup Attitude and Navigation System. Backup attitude and navigation system is simulated.

(6) Identification System. The IFF set is simulated.

r. Mission Computer System. The TOFT uses a software emulator to replace the aircraft's mission computers. The emulator performs most of the same functions as the Mission Computers. MC1 performs processing for the

aircraft built-in test (BIT), aircraft operation status monitoring, and provides backup for MC2, the tactical computer. MC2 performs processing and control/display management for air-to-air combat, air-to-ground attack, navigation, and backup for MC1.

s. Stores Jettison System. The stores jettison system is simulated to provide jettison of external stores and racks as in the aircraft.

t. Weapons Systems. Aircraft air-to-air and air-to-ground weapons are simulated including all conventional and special weapons compatible with the design basis aircraft.

1.3 Instructor Station: The instructor station is integral with the control station.

1.3.1 Control Station. The instructor groups allow an instructor to exercise control over various trainee operations through a windows operating environment. The IOS provides the instructor/operator with controls to initiate, develop, change, freeze and monitor training scenarios. The IOS consist of five graphics CRTs, two speakers, two mouse units, three headset control boxes, one desktop microphone, one flight control stick, one speaker control box, one throttle control stick, two EPO pushbutton switches, and two instructor/operator headsets. The instructor can "FLY" an aircraft using a control stick and throttle. Additionally, the Maintenance personnel can initiate and monitor the Daily Readiness Equipment Diagnostic (DRED) from the IOS.

1.3.2 The principal components are:

a. Console with a work surface

b. Visual Monitors (CRT) for Trainee Station displays selectable functions to allow for various monitoring criteria.

c. Input Devices, e.g. keyboards, mouse, and Throttle control Stick, Flight control stick, etc.

d. Communication equipment, e.g. headset and control, speakers, microphone and volume controls.

1.4 Brief/Debrief Station:

1.4.1 The Brief/Debrief Station (BDS) provides instructors and pilots with the ability to use available simulation data in order to analyze specific interactions and events that take place during a specific training scenario. The BDS consists of one brief/debrief cabinet, sixteen display monitors, a brief/debrief system control station, three 50-inch plasma displays, a 50-inch smart board overlay, and two speakers.

1.4.1.1 The brief/debrief cabinet contains the following equipment:

a. ACEnet Communication Unit PC
b. Link Total Instructional System (LTIS) PC
c. SimuStealth PC
d. Sim Server Telestra

e. Ace Target Telestra PC
f. Audio amplifier
g. KVM switch
h. Video Capture decoder PC
i. 24-port gigabit switch
j. 24-port gigabit switch
k. Line drivers
l. Video distribution amplifier
m. USB extender LEX unit

1.4.2 21-inch Display Monitor. The brief/debrief system consists of four 21-inch LCDs, which are used to display the HUD/NVG, LDDI, RDDI/ADU, and MPCD information.

1.4.3 The brief/debrief system control station consists of the following items:

a. 21-inch display monitor
b. Keyboard
c. Mouse
d. Card reader
e. Keyboard/mouse extender unit
f. USB extender REX unit
g. Joystick
h. Webcam
i. Power strip

1.4.4 50-inch Plasma Display. The three 50-inch plasma display is used to display the PPVD or either of the IOS monitors.

1.5 Computer System, Peripherals, and Interface Cabinets:

1.5.1 The Host computer system consists of ten personal computers (PCs) networked together through a 24-port gigabit Ethernet switch. The host computer provides the necessary timing and control during real-time operations. The Host Computer System consists of a Master PC, five Slave PCs, Host Controller, three Next Generation Target System (NGTS) PCs, 48-port gigabit switch and a 24-port gigabit switch. It performs I/O operations with the other trainer systems. The host computer has several subassemblies, including several modules containing individual circuit cards and other modules containing rack-mounted units. The Master PC is a 4U personal computer containing two Xeon EM64T XD HT 3.8 GHz processors and 4GB RAM with 2 400GB removable hard drives, DVD/CD RW drive, Motherboard, Video circuit card, 10/100/1000 quad Ethernet circuit card, and Reflective memory circuit card. Slave Computer systems are basically configured the same as the Master Host Computer.

1.6 Aircraft Common Equipment: To be Determined

1.7 Power System:

1.7.1 The trainer power distribution system controls and distributes the ac and dc power required to operate the trainer. The system is furnished with 120/208 VAC, 3-phase, 60 Hz power. Various dc voltages are required in some equipment.

1.7.2 All AC power is controlled by Power Management Module (PMM). The PMM receives the 120/208 VAC, 3-phase, 60Hz power from the facility supply. The power cabinet is designed to distribute a maximum of 300 KVA input. The phase sequence of the input power is Phase A,B,C. The power cabinet has a Display Multi-Function Power Monitoring System (DMMS) 300+ Solid State Digital Triple Display Multi-Function Power Monitoring System installed for monitoring power fluctuations. The DMMS can display the current, voltage and power consumption for the total system as well as each phase or between phases.

1.7.3 The DC power required to operate the trainer is furnished through dc power supplies located in the AIC and IOS cabinets. The various power supplies generate +5, +/-10, +/-15, +24 and +28Vdc.

1.8 Visual System:

1.8.1 The visual system consist of nine facets, eight mirrors, nine (9) rear projection visual projectors type Electrohome Marquee 9500LC, a center overlay projector, and a virtual HUD projector provides the out-the-window (OTW) scene. The visual system displays the out-the-window (OTW) visual scenes to support the student training. Scenes are generated via modeled databases stored in the IG combined with simulated on-ground and in-flight inputs from the student pilot interfacing with cockpit controls. The field of view (FOV) for each of the OTW channels is software controllable to match the applicable projection system. Visual system provides a continuous FOV that extends 360 degree in a horizontal plane at 0 degrees elevation and 20 degrees down and 45 degrees up in vertical plane at 0 degree azimuth and 45 degrees down and 20 degrees up at +/-60 degrees azimuth as limited by the fuselage. The Visual System includes visual and radar databases, SimuView™ Image Generator (IG), Head Tracker, virtual head up display (HUD), eleven rear projection display channels, and cabling. The OTW scenes are provided by the visual system, which uses eleven rear projection systems to display the images. The rear projection systems consist of the following: one facet each on the left and right forward, left and right aft, left and right upper forward, upper aft and directly aft which include projector, screen, mirror, and framework; one center system forward of the cockpit which includes projector, pedestal, screen, and one virtual head up display system including a projector and pedestal, which projects the head up display (HUD) on the center facet. A head tracker system provides head motion compensation for the overall visual scene. The visual systems for the FWD and AFT are identical with the following exceptions: The AFT visual system does not containing Improved Fresnel Lens Optical Landing System IFLOLS)node within the PCIG, or the Head Up Display (HUD) and IFLOLS projectors.

1.8.2 SimuView™ Image Generator (IG). The SimuView IG consists of four cabinets containing a group of personal computers networked together and the required supporting hardware to provide high speed real-time graphics scenes for training. The aft IG consists of three OTW cabinets identical to the forward IG with the exception of the IFLOLS PC, which is not installed. The major items contained in the SimuView IG are:

1. Cabinet 1 containing Pager node #1, Master control processor (MPC) #1 node, ISECT node #1, Channel 1 video combiner, Channel 2 video combiner, Channel 3 video combiner, Channel 3 render nodes 1-4, Channel 2 render nodes 1-4, Channel 1 render nodes 1-4, Video amplifier chassis, 24-port gigabit switch, and 16-port gigabit switch

2. Cabinet 2 containing IFLOLS node, Channel 4 video combiner, Channel 5 video combiner, Channel 6 video combiner, Channel 6 render nodes 1-4, Channel 5 render nodes 1-4, Channel 4 render nodes 1-4, 24-port gigabit switch, and Video amplifier chassis
3. Cabinet 3 containing Channel 7 video combiner, Channel 8 video combiner, Channel 9 video combiner, Channel 9 render nodes 1-4, Channel 8 render nodes 1-4, Channel 7 render nodes 1-4, and 24-port gigabit switch
4. Cabinet 4 Pager node #3, MPC #3 Node, ISECT node 3, HUD Node, IOS #1 node, AUX node, Pager node #2, MCP #2 node, ISECT node #2, AGL node, Sensor node #1, Sensor node #2, 24-port gigabit switch (LAN#2), 24-port gigabit switch (LAN#2), and Amplifier chassis (AMP#1-3).

1.8.3 Head Tracker. The visual system provides a function referred to as "Virtual Vignette" which provides head motion compensation so that the overall visual scene perspective due to head motion is correct for both close and distant scene elements. The head tracker transmits and receives information to/from the IG. This information is then transmitted from the PCIG to the host computer. Using the information received from pilot head position, the host computer performs calculations that shift the eye-point position data to the PCIG as a function of the pilot's head position. The effect provides an element of realism that duplicates looking out of an aircraft as opposed to viewing an image on a screen positioned 40 inches from the viewer's eye-point.

1.8.3 Visual Mirror Assembly. The assembly consists of five flat glass and three Mylar mirror assemblies, one on every facet except the center forward facet, are used to reflect the images to the applicable screen. The three mylar mirrors are attached to the top of the visual display. Each mirror is coated with a reflective film.

1.8.4 Visual Projectors. The projectors are Electrohome Marquee 9500LC electromagnetically focused devices using latest technology to provide a simply maintained system incorporating automatic convergence. Each projector contains 3 lens assemblies (red, green, and blue) with the exception of the HUD projector which has 3 green tubes installed.

1.9 Motion System: N/A

1.10 Air Conditioning System: N/A

1.11 Motor Generator Sets: N/A

1.12 Hydraulic System: N/A

1.13 Pneumatic System: Used for opening and closing the ingress/egress door of the cockpit.

2.0 **Illustrations**:

Complete lists of illustrations are available at each training device location.

3.0 **Mission Essential Subsystem Matrix**: Not Applicable

4.0 **CONTRACTED TRAINING TIME:**

Training Operations shall be provided in each FY as per exercised contract CLIN/SLIN per device from one of the stair steps below:

2F201-135 F/A-18 TOFT **Contracted Training Time (CTT) Monday thru Friday (M-F)** **NAF Atsugi, Japan**		
Hours per Week (HPW)	**Start Time (local) (Notional)**	**End Time (local) (Notional)**
20	0800	1200
30	0800	1400
40	0700	1500
Remark(s) / Note(s)		
1-CTT time represents continuous hours of device operational training availability from initial START time. 2- CTT does not include weekend (Saturdays/Sundays) training, and no weekend training planned. 3-CTT daily Start Times are notional and may vary/shift with coordination and direction from the Contracting Officer's Representative (COR)/site scheduling authority and may change during the course of the Task Order. (Refer to Addendum A, paragraph 4.3.1). 4-CTT may be shifted between devices with coordination and direction from the Contracting Officer's Representative (COR) and Contractor Site Manager. 5- Historically the trainer is utilized no more than 8 hours in a training day; however the Government reserves the right to transfer training hours to device 2F201-134 as long as total does not exceed combined CTTs.		
Table 4.1		

5.0 **Government Provided Aircraft Common Equipment (ACE)/Trainer Unique Equipment.**

5.1 Aircraft Common Equipment (ACE)

Complete list of ACE can be found in the inventory list provided at each site.

The Material Support Package (MSP) inventory of this solicitation will be determined by the results of CDRL A005 “COMS/CMS CONTRACTOR INVENTORY/UTILIZATION REPORT OF GFP/GFI”. The results of the transition inventory will be verified and signed by the site COR prior to Contractor’s submission of CDRL A002 to the Government.

NOTE: Whenever minor configuration changes, calibration or adjustment of aircraft common equipment is required for use in the trainer, such information shall be provided in this Appendix.

5.2 Trainer Equipment. Depot level (D-level) maintenance for the following trainer equipment is the responsibility of the government.

Complete list of D-level trainer equipment will be provided at each site.

5.2.1 Trainer Support Package (TSP): Includes Tools/Support Equipment, Spare Parts, Technical Data Support Package, and Software Support Material. The formal inventory (i.e. tools/support equipment, spare parts, technical data support package, and software support material, etc.) shall be those items identified during the mobilization period and stated in the yearly Inventory/Utilization Data Report. The Contractor shall comply with the development, maintenance and submission requirements for this report, as stated in the applicable CDRL item."

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Appendix M

6.0 **PARTIAL MISSION CAPABILITY STANDARD (PMCS)** Partial Mission Capability (PMC) is the material condition of a training device that cannot perform all of its missions. PMC levels are described by Equipment Operational Capability (EOC) codes, which relate to particular training device systems/subsystems to a specific mission. The EOC code also relates to the percentage of deduction from the authorized payment for the affected period. See table below for PMCS deduction schedule.

EOC	% MISSION CAPABLE	% OF DEGRADATION
B	100	0
C	90-99	10
D	80-89	20
E	70-79	30
F	60-69	40
G	50-59	50
H	40-49	60
J	0-39	70

PARTIAL MISSION CAPABLE LISTING
DEVICE 2F201 TACTICAL OPERATIONAL FLIGHT TRAINER (TOFT)

Failed Equipment	EOC Code	PMCF
A. Cockpit Displays		
UFCP	F	40%
LMDI	E	30%
RMDI	E	30%
MPCD	E	30%
ADU	C	10%
IFEI	D	20%
ALR-67	D	20%
B. Cockpit Instruments		
Standby Airspeed Indicator	C	10%
Radar Altimeter	F	40%
Vertical Velocity Indicator	D	20%
Barometric Altimeter	D	20%
Brake Accumulator Pressure Gauge	C	10%
Hyd 1 Hyd 2 Pressure Indicator	C	10%
Battery Indicator	C	10%
Standby Magnetic Compass	C	10%
C. Cockpit Panels		
Advisory and Threat Warning Ind Left	E	30%
Advisory and Threat Warning Ind Right	E	30%
Master Arm Panel	D	20%
Jettison Station Select	C	10%
Heading and Course Switch	C	10%
ECM	C	10%

Video Record	N/A	
Landing Gear	D	20%
Left Hand Vertical Console Control	N/A	
Emergency and Parking Brake	D	20%
Hook Handle	D	20%
Right Hand Vertical Console Control	N/A	
Caution Light Panel	D	20%
Wing Fold Handle	B	
Fire Test Panel	D	20%
Ground Power Panel	B	
Generator Tie Control Switch Panel	D	20%
Exterior Lights Panel	D	20%
Fuel Control Panel	C	10%
Auxiliary Power Unit, Engine Crank Panel	B	0%
Flight Control System Panel	D	20%
Communication Control Panel	D	20%
Antenna Select Panel	B	0%
Hydraulic Isolate Panel	C	10%
Electrical Power Panel	C	10%
Environmental Control Panel	B	0%
Defog Panel	B	0%
Interior Lights Panel	D	20%
Sensor Control Panel	D	20%
Fan Test Panel	D	20%
ECM Dispenser Button Panel	C	10%
Left Hand Circuit Breaker Panel	C	10%
Right Hand Circuit Breaker Panel	C	10%
Knee Board Chart Light	C	10%
Lock/Shoot Indicator	C	10%
Trainer Control Panel	N/A	
ARL-67 Control Panel	D	20%
D. Flight Controls		
Stick Assembly	H	60%
Rudder Assembly	G	50%
Toe Brakes	D	20%
Throttle Quadrant	Z	100%
Ejection Seat	N/A	
C. INSTRUCTOR/OPERATOR STATION		
HUD/OTW Repeater	D	20%
Cockpit Repeater - (IAD-4)	D	20%
Interactive Display - (IAD 1,2,3)	D	20%
Data Entry - (Mouse)	D	20%
Data Entry System - (Keyboard)	D	20%
Instructors A/C Controls - (Stick/Throttle)	C	10%

Audio System - (Headsets/Mics/Speakers)	G	50%
Superview 500 Windowing System	D	20%
D. VISUAL SYSTEM		
JHMCS	E	30%
NVG System	E	30%
52” LCD	G	50%
20" DISPLAY REPEATER - MOC	C	10%
20" DISPLAY REPEATER - B/DS	C	10%
50" DISPLAY REPEATER - MOC & B/DS	C	10%
E. AIRCRAFT SYSTEMS INTERFACE CABINET (AIC)		
Crown Audio Amplifier	Z	100%
VME I/O Chassis	Z	100%
F. COMPUTER/PERIPHERALS		
Host Computer	Z	100%
Image Generator PCIG	Z	100%
Instructor/Operator Systems Cabinet	Z	100%
Mission Computer Emulator (MCE)	Z	100%
IOS Printer Unit (Laser Printer))	C	10%
File Server	Z	100%
Digital Audio Communication System	Z	100%
Simi-Stealth	Z	100%
Logger - IOS	Z	100%
Router	Z	100%
Time Server	Z	100%
Reflective Memory	Z	100%
Gigabit Switch	Z	100%
Telestra (Envir Sound)	Z	100%
G. MOC/BDS		
Printer Unit (Laser Printer))	C	10%
Interactive Display - (IAD 1,2)	C	10%
Data Entry System - Mouse	C	10%
Data Entry System - Keyboard	C	10%
Audio System - (Headsets/Mics/Speakers)	C	10%
Simi-Stealth	C	10%
Joy Stick	C	10%
20" Display Repeater - MOC/BDS	C	10%
50" Display Repeater - MOC & B/DS	C	10%
RTI	C	10%
File Server	C	10%
Encoders	C	10%
Decoders	C	10%

H. POWER DISTRIBUTION SYSTEM		
Main Power Distribution	Z	100%
I. MECHANICAL		
Air Compressor	E	30%
Cylinder, Air	E	30%
Flow Control Valve	E	30%
Pneumatic Control Assy	E	30%
J. INTEGRATED MODE OF OPERATION		
Loss of one cockpit - integrated mission	E	30%
Loss of more than one cockpit - integrated mission	G	50%
Loss of sectional training	Z	100%

7.0 **FLOOR PLANS AND PROJECTED ADDITIONS** A complete list of floor plans and projected additions are available at each training device location.

8.0 **JANITORIAL SCHEDULING REQUIREMENTS** See Appendix AA